# Pediatric Prehospital Medication Errors

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1

## Conflict of Interest Disclosure

- I am an inventor and hold the U.S. patents on 2 drug dosing devices.
  - I don't have any licensing arrangements and don't receive any royalties.

2

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# Objectives

Goals

1. Understand the prevalence of medication dosing errors by EMT-Ps when treating children.
2. Understand the issues- as seen by EMT-Ps -around training, barriers to correct dosing and enablers to correct dosing.
3. Understand some of the frustrations paramedics have regarding this issue.

3

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# Background

- Children are especially vulnerable to drug- dosing errors
- It is well known that drug-dosing errors occur throughout the hospital-based health care system at a rate of 1-11% of all doses.
- Recently, the prevalence of drug-dosing errors in pediatric patients cared for by Emergency Medical Services has become better defined.

4

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# Medical Errors

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- 1999 Institute of Medicine (IOM) report:
  - 3-4% of hospital patients are harmed by the health care system
  - 7% of hospital patients are exposed to a serious medication error
  - 50,000 – 100,000 deaths/ yr from medical mistakes
    - Equivalent of 280 747s crashing in a year with no survivors

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# What about prehospital errors?

- RN/ EMT-P and RN/ MD flight crews Indianapolis mid 1990s
- 1 day to 14 years age group
  - Atropine & epinephrine doses were incorrect up to 42%
  - Sedation and pain meds incorrect 0-77%
  - Succinylcholine incorrect 44%

6

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# Prehospital Errors

- Kaji, et al Pediatrics, October 2006
- LA County Paramedics
- 1994-1997 epinephrine dose error: 65.8% incorrect
  - Fewer errors when Broselow tape used.
- Extensive quality improvement program to decrease error
- 2003-2004 epinephrine dose error: 35% incorrect

7

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Prehospital Errors

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8

# Prehospital Errors

- Lammers, Fales, et al Prehosp Emerg Care 2010
- EMTPs completed pediatric patient simulation scenarios
- Epinephrine dose incorrect: 68-73%
- Failure to use Broselow tape: 50%
- Incorrect use of Broselow tape: 47%

9

# Prehospital Pediatric Medication Errors

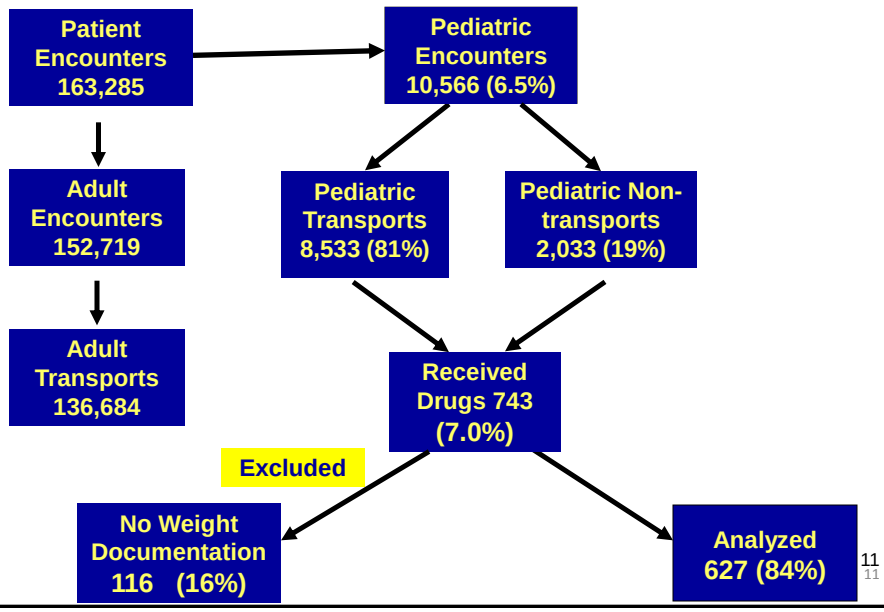
J Hoyle, AT Davis, KK Putman, JA Trytko, WD Fales

To identify the prevalence of drug-dosing errors in pediatric patients treated by Emergency Medical Services (EMS)

- Data from 9 EMS agencies were examined
  - Serve 10% of Michigan's population (1,009,500 persons)
  - Serve a demographically diverse population
- MERMaID data from 2004 through first quarter of 2006
- Received designation as a Medical Research Project from the Michigan Department of Community Health

10

# Results




11

# Results

- For the 10,566 patient encounters:
  - Patient mean age: 9.7±0.1 years
- 56.5% of all drug doses were incorrect
- 50.1% of paramedics did not administer a drug to a pediatric patient during the study period (2.25 yr).
  - Average number of drugs administered by individual paramedics for the study period: 5.25
  - 2.3 per year
- In patients ≤12 years, weight determination via Broselow tape was documented in 12.2%.

12

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# Results

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| Drug | # Correct/ Total | % Correct (95%CI) |
|---|---|---|
| **Albuterol** | 315/383 | 82.2% (78.0-85.7) |
| **Atropine** | 56/83 | 67.5% (56.8-76.6) |
| **Naloxone** | 16/34 | 47.1% (31.4-63.4) |
| **Diphenhydramine** | 15/35 | 42.9% (28.0-59.1) |
| **Epinephrine** | 35/128 | 27.3% (20.4-35.6) |
| **Diazepam** | 10/40 | 25.0% (14.2-40.2) |
| **Midazolam** | 15/63 | 23.8% (15.0-35.7) |
| **Dextrose** | 7/38 | 18.4% (9.2-33.4) |
| **Morphine** | 17/314 | 5.4% (3.4-8.5) |

13

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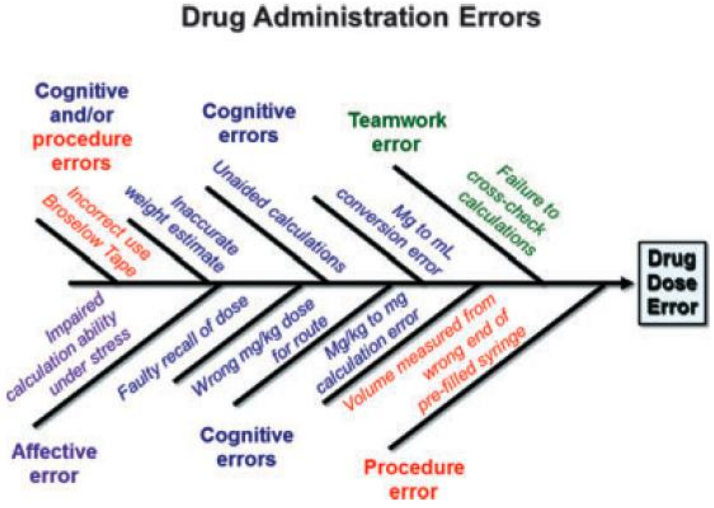
# Where does it go wrong?

*Lammers, Byrwa, Fales AEM 19, 2012*




14

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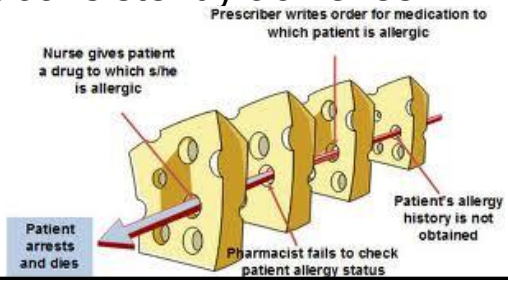
# Systems and errors

- "Medical mistakes are merely human mistakes committed within a human system inadequately designed to catch and neutralize those mistakes"
- "Every system is perfectly designed to get the results it consistently achieves."




15

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# What Next?

- We know there are frequent errors
- We know many/all of the root causes
- How do we intervene?
- Pronovost, et al Johns Hopkins
  - Law of Unintended Consequences is the rule rather than the exception in patient safety improvement
  - Important to have the view of the end user/provider prior to any intervention
  - Interventions should be thoroughly piloted prior to implementation.

16

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## Pediatric Prehospital Medication Errors: A Qualitative Study

- Hoyle, Henry, Chasee, Sleight, Fales, Mavis
- Focus Groups of EMT-Ps throughout Michigan
- Goal: find out EMT-Ps views on;
  - Pediatric Training
  - Barriers to correct drug dosing
  - Enablers to correct drug dosing
  - Potential solutions to decrease errors

17

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## Qualitative Study?

- Focus Groups generate qualitative data- measured in terms of the themes, subthemes and patterns of responses from participants.
  - Look at Macro rather than Micro issues
  - Study completeness is based on saturation of themes (same responses being repeated in groups) not power calculations.
  - Data measured in terms number of responses based on a predetermined coding scheme

18

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# Focus Group

- Groups are recorded and then transcribed
- Investigators then code the responses using specialized software
- Any disagreement regarding assigning a code are resolved by consensus among investigators.

19

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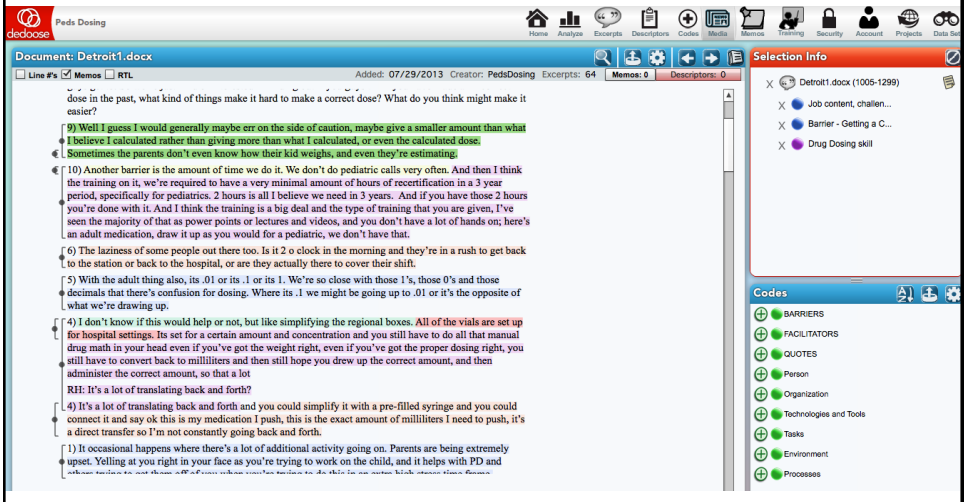
# Coding Software




20

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# Training

- EMT-Ps used some strong language to describe their pediatric training
  - Initial pediatric training during EMT-P school is absent or very little and not viewed as adequate
  - Pediatric retraining (PALS/PEPP) typically takes place every 2 years (or longer) and is viewed as not frequent enough
    - Training not viewed as relevant to a lot of what they do (treat a lot of asthma, but get little training on asthma)
    - Rigor of training is low: "If I show up I get the certification"

21

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# Training

- Training used to be much more difficult to pass and had to be passed on an individual basis. Now viewed as more of a "group project"
- Training is so infrequent that it can't be remembered when needed
- Pediatrics is not emphasized or not covered at regular (monthly/quarterly) training sessions
  - EMT-Ps said they really need pediatrics at every training session

22

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# Training

- Downstream result when faced with a pediatric case:
  - EMT-Ps have a great deal of difficulty remembering drug doses
  - Great deal of difficulty completing calculation(s) to deliver appropriate number of mls.

23

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# Barriers to accurate doses

- Getting a correct weight
  - BLT recognized as helpful BUT:
    - Buried in equip or drug bag (out of sight out of mind-forget it's there)
      - Doesn't get used
    - Measurements mistrusted (due to obesity)
  - Some view themselves as good at estimating, while others do not
  - Some compare child to a child with a known weight (own child, relative)
  - Some ask parent

24

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# Barriers to Accurate Dosing

- EMT-Ps seem to think in pounds
  - Requires another calculation
  - Could lead to pounds as weight error (double dosing)
  - EMT-Ps have said the old state run paper sheet had a pound to kilogram conversion chart-now with electronic charting that is gone
- "I'll go to (RN, MD, EMT-P) after the call to try and figure out if I did it right. 90% of the time I still won't know."

25

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# Barriers to accurate doses

- Drug packaging is not pediatric friendly
  - All drugs "packaged for adults"
  - All peds doses require calculations
- Math calculations are difficult
- BLT can be confusing (includes drugs they don't use-occasionally used upside down)
- Training doesn't include calculating, diluting and administering drugs

26

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# Barriers to Accurate Dosing

- If you're paired with a EMT-B, there is no one to check your calculations.
- Protocols may disagree with PALS or BLT

27

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# Enablers to Accurate Dosing

- EMT-Ps came up with few things in their current practice that are helpful.
  - BLT is helpful
    - Want larger print
    - Want the hospital only drugs taken off
  - Dosing cards that eliminate math
  - Apps
  - A pounds to kilograms conversion table
    - Pounds are scary…

28

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# Potential Solutions

- Eliminating math
  - Drug dosing cards with doses in mls.
    - BUT have issue with drug shortages/ concentration changes
  - Many EMT-Ps use a variety of Apps on their phones
    - Do you know what you're EMT-Ps are using?
- Accurate information from dispatch en route
  - Weight or age-would allow EMT-Ps to start thinking about case earlier
- Checklist to go through on way to a pediatric call

29

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# Where do we go from here?

- Finalize our analysis of the focus groups
- With all of the studies presented here, we hope to develop an intervention that we can start on a regional and then state level.
  - Michigan already leading the way in this area
  - We'll need your help and participation
  - If it goes well Michigan will become a model for the US.

30

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# Thanks

31